Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Section 2.106 of the	)	ET Docket No. 95-18
Commission's Rules to Allocate	)	RM-7927
Spectrum at 2 GHz for Use	)	PP-28
by the Mobile-Satellite Service	)	

FIRST REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULE MAKING

Adopted: March 13, 1997 **Released: March 14, 1997**

Comment Date: 60 days from date of publication in the Federal Register
Reply Comment Date: 90 days from date of publication in the Federal Register

INTRODUCTION

1. By this action, the Commission allocates 70 megahertz of spectrum at 1990-2025 MHz and 2165-2200 MHz to the Mobile-Satellite Service (MSS), effective January 1, 2000. In order to make this spectrum available for MSS use, we are modifying the current Broadcast Auxiliary Service (BAS), Cable Television Relay Service (CARS), and Local Television Transmission Service (LTTS) allocation at 1990-2110 MHz by providing an allocation instead at 2025-2130 MHz and proposing to rechannelize BAS at 2 GHz, from seven channels of 17- and 18-megahertz bandwidths to seven channels of 15-megahertz bandwidth. We are proposing reaccommodation of existing BAS and Fixed Service (FS) operations in the 1990-2025 MHz, 2110-2130 MHz, and 2165-2200 MHz bands in accordance with the policies we established in our Emerging Technologies proceeding.[1] We defer action on technical parameters and licensing issues for MSS in the 2 GHz band. Finally, we dispose of a related pioneer's preference request filed by Celsat America, Inc. (Celsat).

[1] *See In re Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies (Emerging Technologies)*, ET Docket 92-9; *First Report and Order and Second Notice of Proposed Rule Making*, FCC 92-437, 7 FCC Rcd. 6886 (1992); *Second Report and Order*, FCC 93-350, 8 FCC Rcd 6495 (1993); *Third Report and Order and Memorandum Opinion and Order*, FCC 93-351, 8 FCC Rcd 6589 (1993); *Memorandum Opinion and Order*, FCC 94-60, 9 FCC Rcd 1943 (1994); *Second Memorandum Opinion and Order*, FCC 94-303, 9 FCC Rcd. 7797 (1994).

BACKGROUND

2. The 1992 World Administrative Radio Conference (WARC-92) allocated the 1930-1980 MHz (Earth-to-space or uplink) and 2120-2170 MHz (space-to-Earth or downlink) bands in Region 2 and the 1980-2010 MHz (uplink) and 2170-2200 MHz (downlink) bands worldwide to MSS.[2] In the June 1994 *Memorandum Opinion and Order* in GEN Docket No. 90-314 (*PCS Reconsideration Order*), we allocated the 1850-1990 MHz band to terrestrial broadband Personal Communications Services (PCS).[3] We anticipated that PCS would use spectrum intensively, thereby bringing into question the feasibility of MSS in this band. Therefore, it did not appear to be practicable to make a domestic allocation of 2 GHz spectrum for MSS that would be consistent with the international allocations without jeopardizing the availability of spectrum for PCS. Further, in the *PCS Reconsideration Order*, we recognized the potential value of MSS in areas that may not be readily or economically served by PCS, such as sparsely-populated rural areas.[4] We stated there that we intended to initiate a proceeding to investigate possibilities for allocating additional frequencies for MSS at 2 GHz in the near future,[5] and that we would attempt to accommodate MSS within the internationally allocated bands remaining outside the PCS allocation. We also indicated that we intended to pursue additional international allocations for MSS at the 1995 World Radiocommunication Conference (WRC-95).[6]

3. Three petitioners have requested allocations for MSS at 2 GHz. In February 1992, Celsat filed a petition for rule making that, as amended, requests allocation of 40 megahertz in the 1970-1990 and 2160-2180 MHz bands for a hybrid satellite/terrestrial personal communications service.[7] Celsat proposed an integrated satellite/terrestrial cellular and micro-

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[2] *See* Final Acts of the 1992 World Administrative Radio Conference, Malaga-Torremolinos (1992).

[3] *See In re Amendment of the Commission's Rules to Establish New Personal Communications Services* (*PCS Proceeding*), GEN Docket No. 90-314, *Memorandum Opinion and Order*, 9 FCC Rcd 5947 (1994).

[4] *Id.*, at para. 94.

[5] MSS is currently allocated 16.5 megahertz in the 2.4 GHz band, paired with 16.5 megahertz in the 1.6 GHz band. *See In re Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands* (*Big LEOs*), CC Docket No. 92-166, FCC 94-261, *Report and Order*, 9 FCC Rcd 5936 (1994).

[6] *See PCS Proceeding* at para. 97.

[7] Celsat's original petition requested allocation of the 1610-1626.5 and 2483.5-2500 MHz bands for MSS. In July 1993, Celsat amended its petition to reflect its current request. In conjunction with its petition, Celsat also filed a pioneer's preference request, PP-28. We placed this request on public notice and requested comment on it. In October 1993, we initiated a review of the pioneer's preference rules in ET Docket No. 93-266 to assess the effect on these rules of our authority to assign licenses by competitive bidding, as recently authorized by the Congress. *See In re Review of the Pioneer's Preference Rules,* ET Docket No. 93-266, FCC 93-551, *Notice of Proposed Rule Making*, 8 FCC Rcd 7692 (1993). In the *First Report and Order* in that proceeding, we deferred a decision as to whether to apply our existing pioneer's preference rules in situations where tentative pioneer's preference decisions

cellular mobile service that would use code division multiple access (CDMA) technology.[8] It maintained that this system would have benefits and advantages in cost and overall spectrum efficiency relative to separate PCS and MSS systems. It stated that its hybrid MSS service could operate in either a portable (personal) or mobile (vehicular) terrestrial mode, but would be primarily a satellite service. In conjunction with its petition, Celsat filed a request for a pioneer's preference, of which we dispose in section F of the discussion *infra*. In December 1993, TRW, Inc. (TRW) filed a petition for rule making requesting that we allocate 80 megahertz of spectrum in the 1970-2010 MHz and 2160-2200 MHz bands for provision of international MSS by satellites in non-geostationary orbits. TRW argued that these bands represent the only frequencies, suitable for global MSS voice-grade service via hand-held transceivers, that are both allocated internationally for MSS and not already applied for in the United States. TRW asserted that there is a vast untapped market for services provided by global MSS systems, and that the allocation it proposed would help ensure the preeminence of the United States satellite industry. TRW proposed a twelve-satellite constellation that would provide virtually global coverage. In April 1994, the Personal Communications Satellite Corporation (PCSAT), a subsidiary of the American Mobile Satellite Corporation, filed a petition for rule making to allocate the 40 megahertz of spectrum in the 1970-1990 MHz and 2160-2180 MHz bands for a satellite service. PCSAT proposed to build and operate a system compatible with PCS that would provide service to several classes of customers and users in the United States. PCSAT observed that over the last ten years there has been a tremendous growth in the availability and use of wireless services for mobile voice and data communications, but that such services are not available everywhere. It submitted that satellite MSS can provide coverage between islands of terrestrially-based services, such as in rural and remote areas, and can provide a nationwide communications system for law enforcement, public safety, and interstate transportation.

4. On January 30, 1995, the Commission adopted a *Notice of Proposed Rule Making* (*Notice*) in this proceeding.[9] In the *Notice* we tentatively concluded that there is a need for more spectrum for MSS, which would provide the public, especially rural Americans, access to new and competitive services and technologies. In order to be as consistent as possible with the WARC-92 worldwide MSS allocation without impinging on the 1850-1990 MHz PCS allocation, we proposed to allocate 70 megahertz in the 1990-2025 MHz (uplink) and 2165-2200 MHz (downlink) bands to MSS.

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have not been issued. *See First Report and Order*, 9 FCC Rcd 605 (1994).

[8] Spread spectrum CDMA is a digital transmission technique in which the signal occupies a bandwidth larger than that needed to contain the information being transmitted. Because the signal is spread over a wide bandwidth, the power is dispersed and interference potential is reduced. The spreading is accomplished by modulating the signal by a code that is independent of the information data. A synchronized code in the receiver is used to de-spread the signal and recover the information. The spreading and the variation in the code permit a number of users to operate on the same frequency simultaneously without causing harmful interference.

[9] *In re Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, ET Docket No. 95-18, FCC 95-39, *Notice of Proposed Rule Making*, 10 FCC Rcd 3230 (1995).

5. The 1990-2025 MHz band is part of the 1990-2110 MHz band that is currently allocated for and used heavily by BAS, and is also authorized for use by CARS and the LTTS.[10] For the purposes of this proceeding, we will refer to all three of these services as "BAS." We proposed to modify the allocation for BAS at 2 GHz and to relocate current licensees in the 1990-2025 MHz band to the 2110-2145 MHz band. Current BAS operations at 1990-2110 MHz are divided into seven channels[11] that are used for the transmission of television signals from fixed and mobile locations. Applications of BAS include electronic news gathering (ENG) mobile units, which transmit television signals to studios; studio-transmitter links, which carry television signals from studios to broadcast antennas; and relay stations, which re-transmit television signals. ENG applications are the predominant use of the 1990-2110 MHz band. We tentatively concluded that MSS and BAS sharing of the 1990-2025 MHz band would not be feasible because of the potential for interference between the two services. Under our proposal in the *Notice*, the new BAS band would be at 2025-2145 MHz, and the total amount of spectrum available to BAS at 2 GHz would remain 120 megahertz.[12]

6. Further, we proposed in the *Notice* to relocate FS licensees from both the 2110-2145 MHz and the 2165-2200 MHz bands.[13] The 2165-2200 MHz band is currently allocated to the Fixed and Mobile Services and is used by commercial and private FS microwave licensees, but has been reserved for services that use emerging technologies.[14] In the *Notice*, we proposed to relocate the existing FS licensees at 2110-2145 MHz and 2165-2200 MHz to bands above 5 GHz, in accordance with our Emerging Technologies rules, which made five bands above 5 GHz available for FS licensees. According to these rules, the emerging technology service provider must guarantee payment of all relocation expenses, build the new microwave facilities at the relocation frequencies, and demonstrate that the new facilities are comparable to the relocated facilities.[15]

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[10] *See* 47 C.F.R. §§ 74.602, 78.18(a)(7), and 21.801(b).

[11] The first channel has a bandwidth of 18 megahertz, and the other six channels have bandwidths of 17 megahertz each; *e.g.*, BAS Channel A1 occupies 1990-2008 MHz , BAS Channel A2 occupies 2008-2025 MHz, etc. *See* 47 C.F.R. Section 74.602.

[12] *See Notice* at ¶¶ 9-10.

[13] *See Notice* at ¶¶ 10, 14.

[14] *See Emerging Technologies, First Report and Order and Third Notice of Proposed Rule Making*, 7 FCC Rcd 6886 at ¶ 21.

[15] *See id.* at ¶ 11 (citing *Emerging Technologies, First Report and Order and Third Notice of Proposed Rule Making*, 7 FCC Rcd 6886, 6890 (1992).

7. We inquired whether we should make the new MSS spectrum available for use by both geostationary (GSO) and non-geostationary or low-Earth orbit (LEO) satellites.[16] We did not propose any specific technical standards for MSS systems to operate in these bands, but requested comment on whether such technical standards are needed, and if so, what they should be.[17] Finally, we gave notice of our intention to allocate MSS licenses in these bands by competitive bidding.[18]

8. As it affects the bands addressed in this *Report and Order*, WARC-92 allocated the 1990-2010 MHz and 2170-2200 MHz bands to MSS worldwide, and the 2165-2170 MHz band to MSS in Region 2. WRC-95 adopted additional international allocations for MSS. As a result of the actions taken at WRC-95, effective January 1, 2000, the 1990-2010 MHz (uplink) and 2170-2200 MHz (downlink) bands will remain allocated to MSS worldwide, and the 2165-2170 MHz (downlink) band will remain allocated to MSS in Region 2. Also effective January 1, 2000, the 2010-2025 MHz (uplink) band will be available for MSS in the United States and Canada. Effective January 1, 2005, the 2010-2025 MHz (uplink) band will be allocated to MSS in all of Region 2.[19]

9. We received twenty-three comments and twenty-three reply comments in response to the *Notice*. Because these comments and replies were filed before WRC-95, we allowed filing of supplemental comments in order to reflect the actions of WRC-95 and the work done by industry groups in the period subsequent to the closing date for reply comments in the *Notice*.[20] We received twenty supplemental comments in response to our request for supplemental comments.

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[16] *See Notice* at ¶ 1.

[17] *See id.* at ¶ 16.

[18] *See id.* at ¶ 17.

[19] Generally, WARC-92 allocated the 1930-1980 MHz band to MSS in Region 2, and the 1980-2010 MHz band to MSS worldwide. The 2010-2025 MHz band was not allocated to MSS. In the upper band, WARC-92 allocated the 2120-2170 MHz band to MSS in Region 2, and the 2170-2200 MHz band to MSS worldwide. WRC-95 retained the allocation of the 1930-1970 MHz band to MSS in Region 2, deleted the allocation of the 1970-1980 MHz band to MSS in Region 2, retained the allocation of the 1980-2010 MHz band to MSS worldwide, and retained the allocation of the 2120-2170 MHz band to MSS in Region 2 and the allocation of the 2170-2200 MHz band worldwide, all changes effective January 1, 2000. Additionally, WRC-95 allocated the 2010-2025 MHz band to MSS in Region 2 effective January 1, 2005. The United States and Canada entered a footnote to this allocation so that the 2010-2025 MHz band will be usable by MSS in the United States and Canada effective January 1, 2000. *See* the band plan chart at Appendix A.

[20] *See* Public Notice, DA 96-577 (April 17, 1996).

FIRST REPORT AND ORDER

A. Spectrum Allocation.

10. In the *Notice*, we proposed to allocate 70 megahertz of spectrum at 1990-2025 MHz and 2165-2200 MHz to MSS. We sought comment on whether 70 megahertz of spectrum would be the appropriate amount to reallocate to 2 GHz MSS, and requested comment on two alternatives for satisfying 2 GHz MSS demand. The first alternative called for immediately allocating 40 megahertz of spectrum at 1990-2010 MHz and 2180-2200 MHz to MSS, and waiting until the outcome of WRC-95 to decide on further allocations. The second alternative called for allocating 60 megahertz at 1990-2020 MHz and 2170-2200 MHz to MSS, as a compromise between the primary proposal and the first alternative.[21]

11. *Comments.* The majority of commenters addressing the allocation issue support the proposed allocation of 70 megahertz, stating that there is a need for more MSS spectrum than is currently allocated.[22] In support of the 70 megahertz allocation, Motorola, Inc. (Motorola) and PCSAT point out that the Industry Advisory Committee to WRC-95 estimated that between 150 and 300 megahertz will be needed for MSS by the year 2005.[23] The Loral/Qualcomm Partnership, L.P. (LQP) agrees, stating that the Commission recognized the need for more MSS spectrum by supporting MSS allocations at WRC-95 and at WARC-92, by allocating spectrum for LEO systems, and by finding the need for more spectrum in the report of the Conference Preparatory Meeting for WRC-95.[24] Several parties oppose the allocation of any spectrum in the 2 GHz range to MSS. The American Petroleum Institute (API) claims that demand for mobile communications is likely to be filled by a combination of PCS, Specialized Mobile Radio, and currently authorized MSS.[25] The Association of Public-Safety Communications Officers-International (APCO) asserts that the public safety microwave services, such as police, fire, and emergency medical communications, are a more important use of the 2110-2145 MHz and 2165-2200 MHz bands than more MSS communications.[26] BellSouth Corporation (BellSouth) also states that the services currently occupying the subject bands, commercial and private operational

[21] *See Notice* at ¶ 15.

[22] *See* Celsat Comments at 4; Constellation Communications, Inc. (Constellation) Comments at 1; Hughes Telecommunications and Space Company (Hughes) Comments at 2; Loral/Qualcomm Partnership, L.P. (LQP) Comments at 3-6; Motorola, Inc. (Motorola) Comments at 6-9; PCSAT Comments at 2-4.

[23] *See* Motorola Comments at 7; PCSAT Comments at 3.

[24] *See* LQP Comments at 4-5 (citing *In re Preparation for International Telecommunication Union World Radiocommunication Conferences (CPM Report)*, IC Docket No. 94-31, FCC 95-256, 10 FCC Rcd 12783 (1995)).

[25] *See* API Comments at 6-8.

[26] *See* APCO Comments at 2.

microwave communications, are a better use of this spectrum than MSS.[27] Southwestern Bell Mobile Systems (Southwestern Bell) supports allocating 40 megahertz at 1990-2010 MHz and 2180-2200 MHz to MSS, but claims that reallocation of 2165-2180 MHz to MSS and relocation of FS licensees to bands above 6 GHz would harm rural cellular service. Southwestern Bell uses the 2165-2180 MHz band for "backhaul" links, interconnecting cell sites with each other and with mobile switching centers. Because propagation above 6 GHz requires shorter paths, Southwestern Bell claims that reallocation of the 2165-2180 MHz band would require rural cellular providers to deploy additional facilities and antennas, impeding our stated goal of providing communications access to rural and underserved areas.[28]

12. In reply comments, several parties express skepticism over the need for additional MSS spectrum and argue that our allocation proposals are not justified.[29] Several other parties state that we should wait until other mobile systems are more developed, and then study the need for MSS spectrum again.[30] Alcatel Network Systems, Inc. (Alcatel) opposes allocation of 2 GHz spectrum to MSS, stating that the Commission ignores the acute shortage of spectrum for FS operations.[31] MSS interests generally reiterate their support for our proposed allocation, arguing that only one commenter flatly opposed any allocation for MSS at 2 GHz,[32] and that there remains a demonstrated need for MSS spectrum.[33] TRW supports an allocation, but recommends that we delay concluding this proceeding until a consensus emerges on how much spectrum to allocate to MSS.[34] Finally, in supplementary comments, API reiterates its opposition to the allocation, pointing out that much of the replacement spectrum for FS licensees identified in our Emerging Technologies proceeding has been reallocated to other uses, leading to a critical shortage of replacement spectrum for FS licensees.[35]

13. *Decision.* We find that it is in the public interest to allocate spectrum at 2 GHz to MSS. We note that the Radiocommunication Sector of the ITU estimates that up to 206

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[27] *See* BellSouth Comments at 2-3.

[28] *See* Southwestern Bell Comments at 3-4.

[29] *See* U.S. Sugar Reply at 6; Telecommunications Industry Association (TIA) Reply at 5.

[30] *See* API Reply at 2; TIA Reply at 5-6; TRW Reply at 3-4.

[31] *See* Alcatel Reply at 2-4.

[32] *See, e.g.,* Celsat Reply at 2; PCSAT Reply at 2-3.

[33] *See* Motorola Reply at 7-9.

[34] *See* TRW Reply at 3-4.

[35] *See* API Supplementary Comments at 2-3.

megahertz of additional spectrum will be needed for MSS by the year 2005.[36] We believe that MSS would also provide another option for mobile communications, and would provide communications to underserved areas, such as rural and remote areas where PCS, cellular, and other mobile services are less feasible. There is clearly substantial interest in providing MSS communications in the 2 GHz band, as demonstrated by the ten commenters who indicated they plan to provide mobile satellite service in the 2 GHz band.[37]

14. We further find that it is in the public interest to allocate the full 70 megahertz at 1990-2025 MHz (uplink) and 2165-2200 MHz (downlink) to MSS as proposed, rather than a lesser amount. Because of the projected need for more MSS spectrum internationally, WRC-95 reallocated the 2010-2025 MHz portion to MSS in Region 2, effective January 1, 2005. As we stated in the *Notice*, we believe that any 2 GHz MSS allocation should be as consistent as possible with the WARC-92 and WRC-95 allocations. This will help ensure truly universal service.[38] In making our domestic allocation, therefore, we are supporting international plans for MSS in the 2 GHz band. We believe that this allocation will allow the United States to participate in global MSS systems and realize the benefits to consumers of such systems. A 70 megahertz will also provide sufficient bandwidth for the operation of multiple service providers. In this regard, we observe that only one party, Southwestern Bell, supported allocation of less than 70 megahertz to MSS.

15. Much of the spectrum for the proposed reallocation was identified as appropriate spectrum for reallocation to emerging technologies, such as MSS, in our Emerging Technologies proceeding. Some parties complain of scarcity of replacement spectrum in the 6 and 11 GHz bands for 2 GHz incumbents. In our Emerging Technologies proceeding, however, we reallocated the 1850-1990, 2110-2150, and 2160-2200 MHz bands from FS to emerging technologies, a total of 220 megahertz.[39] We made a total of 2,480 megahertz of spectrum available for relocated FS licensees in the 4, 6, 10, and 11 GHz bands.[40] Even though some of the higher-frequency spectrum is shared with other services, we believe that there is enough spectrum in those bands to accommodate relocation of the incumbents of 220 megahertz of spectrum, including the existing 2110-2130 MHz and 2165-2200 MHz FS licensees.

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[36] *See CPM Report*, 10 FCC Rcd 12783 at ¶ 39.

[37] Satellite companies expressing an interest in providing service are Celsat; COMSAT; Constellation; GE American Communications, Inc. (GE Americom); Iridium, Inc. (Iridium); LQP; Newcomb Communications, Inc. (Newcomb); PCSAT; Teledesic Corporation (Teledesic); and TRW.

[38] *See Notice* at ¶ 8.

[39] *See Emerging Technologies, First Report and Order and Third Notice of Proposed Rule Making*, 7 FCC Rcd 6886 at ¶ 21.

[40] *See Emerging Technologies, Second Report and Order*, 8 FCC Rcd 6495 at App. A.

B. Relocation of Existing 1990-2025 MHz Band Services.

16. As indicated above, the 1990-2025 MHz band is part of the 1990-2110 MHz band that is currently allocated to BAS, CARS, and LTTS. We reiterate that for this proceeding, we will collectively term these services BAS, and any changes in our regulatory structure applicable to BAS will be equally applicable to CARS and LTTS. We will treat CARS and LTTS in the same manner as BAS because both CARS and LTTS are authorized users of the 1990-2025 MHz band, and have invested in equipment to use the band, as has BAS. In the *Notice*, we observed that sharing between MSS and BAS is not feasible. We therefore proposed to add 35 megahertz of spectrum to the upper end of the BAS band at 2110-2145 MHz and to relocate BAS incumbents currently occupying 1990-2025 MHz to 2110-2145 MHz.[41] This proposal would provide BAS with the same amount of spectrum it currently has. As possible alternatives, we inquired into the feasibility of requiring BAS incumbents to adopt more spectrally efficient technology to operate in the remaining 85 megahertz at 2025-2110 MHz, or into the feasibility of moving all BAS operations to a higher frequency band.[42] We further proposed requiring MSS providers to bear the cost of relocating the BAS incumbents.[43]

17. *Comments.* Broadcasting interests generally do not oppose the proposed relocation of the BAS band, but insist that BAS should not suffer a net loss in total spectrum, and that MSS should pay all costs of any relocation. The Association for Maximum Service Television *et al.*, filing jointly (MSTV) assert that BAS is vital to the health of the broadcasting industry and to the information needs of the American public. MSTV contends that demand for BAS spectrum already exceeds capacity and that reducing BAS spectrum would therefore hurt broadcasting. Further, MSTV insists that BAS needs spectrum in the 2 GHz band because this band has favorable propagation characteristics for transmission along non-engineered paths. The 4, 6, and 12 GHz bands that would be candidates for BAS use are less favorable, according to MSTV.[44] The Society of Broadcast Engineers (SBE) agrees that BAS spectrum should not be reduced, because of the heavy use of the spectrum, and that the excellent propagation characteristics of the band make it important that BAS remain at 2 GHz. SBE points out that broadcasters have already voluntarily relocated their fixed links from 2 GHz to the 7 and 13 GHz bands in order to leave 2 GHz clear for mobile ENG operations. Further, SBE points out that the Commission had excluded the BAS band from the Emerging Technologies proceeding, because of the heavy use of the band. If it is necessary to relocate BAS, SBE supports our proposal to reallocate the 2110-2145 MHz band, retaining a contiguous 120-megahertz band for BAS at 2 GHz, namely the 2025-2145 MHz band. As regards reducing the total spectrum for BAS, SBE states that 17-

[41] *See id.* at ¶ 9.

[42] *See id.* at ¶ 13.

[43] *See id.* at ¶ 10.

[44] *See id.* at 11-17.

megahertz wide channels are needed for contribution quality signals,[45] and that the advent of digital technology will require more, not less, bandwidth.[46]

18. MSTV states that if BAS is to be relocated, the relocation should be in accordance with the PCS relocation rules, which were adopted in our Emerging Technologies proceeding. It argues that we should allow a "reasonable" time, defined as at least through January 1, 2005, for the voluntary relocation negotiations called for by the PCS relocation rules.[47] SBE agrees that MSS should pay all relocation costs, including the cost of clearing current FS operations from the 2110-2145 MHz band; it points out that most ENG operations use the same equipment for access to all seven channels, so that in most cases, all ENG equipment will need to be replaced.[48]

19. SBE states, however, that an acceptable alternative to relocation of BAS out of the 2 GHz band is to compress each of the seven affected BAS channels to a bandwidth of 15 megahertz. This would decrease the 2 GHz spectrum allocated to BAS from the current 120 megahertz to 105 megahertz, and would thus free 15 megahertz for MSS use. In return for such rechannelization, SBE claims that BAS licensees should receive new FM video equipment, at the expense of MSS. SBE states that this solution would be less costly than relocation.[49]

20. The Association of Federal Communications Consulting Engineers (AFCCE) supports our proposal for BAS relocation, agreeing with our conclusion that sharing between BAS and MSS is not feasible.[50] Finally, Creative Broadcast Techniques, Inc. and the New Vision Group, Inc. (CBT) note that LTTS also occupies the BAS band, and should be treated in the same manner as BAS.[51] CBT asserts that LTTS cannot share spectrum with MSS or FS, and argues that if LTTS loses access to the 1990-2025 MHz band, it should be compensated with spectrum at 2110-2145.[52]

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[45] BAS signals used by ENG must be of sufficient bandwidth to provide the high quality and precision video and audio for direct input into television broadcast. Signals of this high quality are called contribution-quality signals.

[46] *See* SBE Comments at 1-6.

[47] *See* MSTV Comments at 6-10 (citing *Emerging Technologies, Report and Order*, 9 FCC Rcd. 1943,1943-44, 1948 (1994); *Third Report and Order*, 8 FCC Rcd 6589, 6602-04 (1993)).

[48] *See* SBE Comments at 7.

[49] *See id.* at 8.

[50] *See* AFCCE Comments at 2.

[51] *See* CBT Comments at 3-5.

[52] *See id.* at 6-8.

21. The positions of MSS interests disagree substantially with those of broadcasting interests. MSS interests oppose our proposal to require MSS to bear the cost of relocating BAS. COMSAT estimates the cost of relocating BAS in accordance with our proposal at approximately $275 million.[53] Motorola estimates the cost of moving BAS channels A1 and A2 per our proposal at approximately $90 million.[54] PCSAT states that MSS should not have to pay for BAS relocation, which it estimates would cost approximately $39 million. Rather, PCSAT would have the Commission encourage BAS licensees to relocate voluntarily over time, and at most limit compensation from MSS to, at most, the incremental cost of early retirement of equipment.[55] TRW also argues that MSS should not have to pay for relocation of BAS. According to TRW, the Commission allocated to PCS spectrum at 1970-1990 MHz that was allocated internationally to MSS; therefore, PCS displaced MSS from this spectrum, and PCS providers should have to pay the cost of relocating BAS from 1990-2025 MHz, which is replacement spectrum for MSS. Otherwise, TRW states, the high cost of relocating BAS would discourage MSS from using the 2 GHz band. TRW also argues that if relocation costs are imposed on MSS, we should apportion costs equally between foreign and domestic MSS systems, and that we should provide assistance in relocation negotiations, such as tax certificates for the sale or exchange of property in connection with relocation.[56] Most MSS commenters argue that BAS should be relocated with little or no cost to MSS. Celsat asserts that, if relocation of BAS is necessary, it should be accomplished in a manner that diminishes unnecessary costs to MSS.[57] Iridium suggests that we adopt a sunset policy on relocation compensation, under which BAS incumbents would be compensated for relocation costs only until a certain date. After that date, BAS licensees who had not relocated would be forced to do so at their own expense.[58]

22. Motorola argues that all BAS operations should be moved out of the 2 GHz band, leaving the 1850-2200 MHz range for aggregation of mobile services. Motorola states that moving all BAS 2 GHz operations to the 6 or 12 GHz bands would save MSS the cost of relocating FS licensees who would otherwise be displaced by BAS in the 2110-2145 MHz band. LQP contends that we should encourage migration of BAS to other bands by making the BAS allocation secondary in the 1990-2025 MHz band on a particular date, and requiring that all license renewal applications contain a plan for migration. LQP urges us to impose a freeze on new applications for BAS licenses at 2 GHz to minimize the relocation burden. LQP also

[53] *See* COMSAT Comments at 11-14.

[54] *See* Motorola Comments at 21-22.

[55] *See* PCSAT Comments at 6-10.

[56] *See id.* at 13-18.

[57] *See* Celsat Comments at 7-8.

[58] *See* Iridium Comments at 1-2.

recommends establishing a Federal Advisory Committee (FAC) to resolve transition issues.[59] Constellation believes that we should study relocation and spectrum issues further before reaching a decision.[60]

23. Celsat advocates our alternative proposal of requiring BAS to rechannelize to fit its operations into the 85 megahertz of spectrum remaining after the 1990-2025 MHz band is reallocated. Celsat claims that the Commission has the authority under 47 U.S.C. 303(g),(r) to require licensees to use more spectrum-efficient equipment. TRW agrees, advocating reducing BAS spectrum to 85 megahertz by requiring current BAS 2 GHz operations to switch to digital technology, and, at the same time, it advocates moving BAS out of the 2 GHz band.[61] COMSAT advocates a two-stage plan whereby we would require an adjustment of BAS 2 GHz operations from the current 17- or 18-megahertz channels to 16-megahertz channels, allowing MSS to operate in the eight megahertz cleared by the rechannelization. In the second stage, we would require BAS to rechannelize again to 12-megahertz channels using digital equipment, which would allow BAS to operate in the remaining 85 megahertz of BAS spectrum.[62]

24. One FS commenter, APCO, states that the 2110-2145 MHz band should not be allocated to BAS, but rather to FS for advanced public safety microwave communications, to compensate FS for its loss of the 2165-2200 MHz band. APCO advocates requiring BAS to operate in the remaining 85 megahertz of the BAS band. In support of this proposal, APCO points out that the National Telecommunications and Information Administration (NTIA) reports that 50 megahertz of additional spectrum is needed for public safety FS communications.[63]

25. In its reply comments, MSTV argues that a channel width of 12 megahertz, as suggested by COMSAT, is not feasible.[64] SBE states that a reduction of one megahertz per channel would be tolerable when more spectrum-efficient hardware is available.[65] In response to Motorola's suggestion that we move BAS out of the 2 GHz band entirely, MSTV asserts that the 7 and 13 GHz bands are unsuitable for mobile ENG activity. MSTV also states that Motorola significantly underestimates the cost of relocating BAS, which MSTV and SBE place at approximately $171 million. This estimate includes the costs of replacing or retrofitting

[59] *See* LQP Comments at 7-13.

[60] *See* Constellation Comments at 3-4.

[61] *See* TRW Comments at 7-12.

[62] *See id.* at 17-23.

[63] *See* APCO Comments at 3-5 (citing NTIA, U.S. National Spectrum Requirements: Projections and Trends, Spec. Pub. 94-31 at 38 (1995)).

[64] *See* MSTV Reply at 4-10.

[65] *See* SBE Reply at 2-5.

transceiver equipment and antennas for all BAS licensees nationwide. MSTV supports our proposal to reallocate the 2110-2145 MHz band to BAS, which would then have available 120 megahertz of spectrum at 2025-2145 MHz.[66] SBE also opposes the idea of freezing BAS license applications or establishing a date after which BAS licensees would no longer be compensated for relocation, because such measures would give MSS licensees incentive to avoid bargaining in good faith on relocation issues.[67]

26. In its reply comments, COMSAT states that BAS should reduce its bandwidth requirements in anticipation of digital technology, because the cost of relocating BAS to the 2110-2145 MHz band, with the attendant cost of clearing that band, would make global MSS financially infeasible. LQP calls for a FAC to study and implement a transition plan.[68] PCSAT supports voluntary negotiations on relocation for 70 days or until a solution is reached and, failing resolution, supports LQP's proposal of a FAC. PCSAT contends that relocation costs would cripple the nascent MSS industry.[69]

27. In supplemental comments, the MSS Coalition[70] recommends a two-phase plan to compress BAS spectrum. In the first phase, the Commission would require licensees in BAS channel A1 (1990-2008 MHz) to vacate by January 1, 2000, either retuning equipment for all BAS channels to use channel bandwidths of 14 or 15 megahertz, or moving to other spectrum. In the second phase, the Commission would require licensees in BAS channel A2 (2008-2025 MHz) to vacate by January 1, 2005, again either retuning all channels to bandwidths of 12 or 13 megahertz, to take advantage of digital compression techniques, or relocating to another band. Under this MSS Coalition plan, BAS would bear the expense of its own relocation. The MSS Coalition claims that ordinary equipment replacement schedules will allow most BAS licensees to retune or replace equipment, or to relocate with minimal additional expense above normal equipment replacement. To support this plan, the MSS Coalition urges us to freeze immediately all new BAS licensing in channels A1 and A2.[71] LQP supports the MSS Coalition plan, but with three modifications. LQP urges that first, all BAS license applications and renewals should be frozen immediately, to avoid further complications in the band clearing process. Second, it argues that we should adopt an ending date for BAS primary operations of January 1, 2005, in order to give BAS licensees incentive to seek new spectrum and to allow MSS to plan on the basis of unrestricted use as of that date. Third, it urges us to allocate replacement BAS spectrum

[66] *See id.* at 11-14.

[67] *See* SBE Reply at 2-5.

[68] *See* LQP Reply at 6-8.

[69] *See* PCSAT Reply at 4-5.

[70] "MSS Coalition" is a collective name for supplemental comments filed jointly by Celsat, COMSAT, I-CO, Hughes, and PCSAT.

[71] *See* MSS Coalition Supplemental Comments at 14-16, 22.

for the 1990-2025 MHz band, and suggests as a possibility the 3650-3700 MHz band, which will be reassigned from Government to non-Government use in 1999.[72]

28. In response to the MSS Coalition proposal, MSTV states that the spectrum allocation proposal of the *Notice* is sound and is the only plan that would be effective, given the heavy and still growing use of BAS. According to MSTV, the MSS Coalition plan is unrealistic, given the current state of the art in BAS equipment; and we should not adopt a plan that relies on anticipated but uncertain future advances in the state of the art. SBE states that channels of 15 megahertz are possible, but that narrowing BAS channels must be accompanied by new equipment capable of tuning to the narrower channels and having narrower intermediate frequency bandpass to avoid degradation in adjacent-channel rejection.[73]

29. One MSS proponent, Iridium, objects to the MSS Coalition's two-phase plan, stating that it is inconsistent with the international allocations of the bands. Iridium claims that, globally, the Coalition's Phase One uplink band of 1990-2008 MHz would be paired with two different downlink bands: 2165-2185 MHz in Regions 1 and 3, and 2180-2198 MHz in Region 2. Iridium states that the MSS Coalition's proposal does not include a coherent plan for the downlink band. Further, Iridium claims that the MSS Coalition's plan would probably only allow operation of one MSS system in the Phase One period, and that system would have an overwhelming competitive advantage flowing from its five-year head start.[74]

30. *Decision.* Based on the record, we conclude that it is necessary to relocate BAS in order to accommodate MSS in the 1990-2025 MHz band. As we indicated in the *Notice*, and the commenting parties agree, BAS and MSS cannot share the spectrum without unacceptable mutual interference. Therefore, to reallocate the 1990-2025 MHz band to MSS, it will be necessary to clear this band of BAS.

31. We reject Motorola's suggestion that we remove BAS from the 2 GHz band entirely. We agree with commenters who point out that the 2 GHz band has ideal propagation characteristics for mobile services including BAS, which must transmit along unengineered paths from unpredictable locations.

32. BAS currently operates with 17- and 18-megahertz wide channels. Comments from both MSS interests and broadcasting interests lead us to believe that BAS may not need channels this wide, especially in light of the fact that advances in radio technology since the current channelization of BAS was established could make it possible for BAS to transmit contribution-quality signals in somewhat narrower channels. On the other hand, we do not agree with the position of the MSS community that we should reduce BAS to 12- and 13-megahertz channels

[72] *See* LQP Supplemental Comments at 4-9.

[73] *See* SBE Supplemental Comments at 1-3.

[74] *See* Iridium Supplemental Comments at 3-6.

and mandate a switch to digital transmission. We believe that a reduction of five megahertz per channel is too severe to permit FM analog contribution-quality BAS signals, and we do not believe that this is the appropriate proceeding to determine whether or when BAS should convert to digital format in conjunction with the development of digital television. Some representatives of both industries, however, agree that BAS may be able to operate with 15-megahertz channels.[75] We conclude that the best solution for BAS relocation is to reduce the BAS band at 2 GHz from 120 to 105 megahertz, and relocate the band from 1990-2110 MHz to 2025-2130 MHz. This would allow the resultant BAS band to be divided into seven channels of 15 megahertz each, thus retaining the current capacity of the BAS band. This solution is more spectrum-efficient than our primary proposal in the *Notice* of simply relocating the 120-megahertz BAS band upward by 35 megahertz, and also more feasible than our alternate proposal of reducing the BAS band to 85 megahertz. Further, this solution will require the relocation of FS users from only 20 megahertz at 2110-2130 MHz, rather than 35 megahertz at 2110-2145 MHz, as in our primary proposal. However, we merely note here that a BAS band of 105 megahertz will allow seven BAS channels. Rather than mandating channels in the new band, we explore possible alternate channelizations in the *Further Notice of Proposed Rule Making* (*Further Notice*), below.

33. Relocating BAS will require retuning of BAS equipment, and in many if not most cases replacing equipment or retrofitting equipment to allow improved intermediate frequency bandpass and adjacent-channel rejection, as pointed out by SBE.[76] Because the new BAS band is in the same region of the spectrum as the current BAS band, we anticipate that no new facilities will need to be constructed. We do not foresee that there will be any need physically to relocate or rebuild any facilities. We are confident that the reaccommodation of BAS operations can be accomplished by simply replacing or retrofitting current equipment. The cost of all steps necessary for clearing the 1990-2025 MHz band for MSS operations will be borne by MSS operators. The *Further Notice of Proposed Rule Making* (*Further Notice*), below, proposes rules and policies for clearing the 1990-2025 MHz band for MSS.

C. *Relocation of Existing 2165-2200 MHz Band Services.*

34. The 2165-2200 MHz band is currently allocated to private and commercial FS, but has been reserved for emerging technologies, such as MSS.[77] In the *Notice*, we stated that five higher bands have already been allocated during our Emerging Technologies proceeding for reaccommodation of the FS incumbents.[78] We inquired whether sharing between MSS and FS

[75] *See, e.g.*, MSS Coalition Supplemental Comments at 14-16; SBE Comments at 8.

[76] *See* SBE Supplemental Comments at 1-3.

[77] *See Notice* at ¶ 14.

[78] *See id.* at ¶ 11. In the Emerging Technologies proceeding, we allocated the 3700-4200 MHz, 5925-6425 MHz, 10.55-10.68 GHz, and 10.7-11.7 GHz bands to private FS and the 6525-6875 MHz band to commercial FS on a primary basis. *See Emerging Technologies, Second Report and Order*, 9 FCC Rcd 6495, 6523 (1993).

would be feasible, and whether FS incumbents should be relocated. Finally, we proposed to require that MSS pay the costs of relocating FS incumbents, where necessary.[79]

35. *Comments on MSS/FS Spectrum Sharing.* In general, the MSS community advocates sharing between FS and MSS, at least in the early stages of MSS deployment.[80] COMSAT presents studies which purport to demonstrate that sharing between FS and MSS downlinks in the 2165-2200 MHz band is feasible. Based on these studies, COMSAT claims that relocation of FS incumbents in the band is unnecessary.[81] Constellation states that the Commission should conduct technical studies to determine the feasibility of sharing in the 2 GHz band, especially with respect to CDMA systems which have low power levels.[82] LQP also asserts that it has conducted studies that demonstrate that MSS/FS sharing is feasible, and urges us to convene a FAC to resolve transition issues, including spectrum sharing.[83]

36. Motorola, however, states that COMSAT's model has several shortcomings which must be addressed before we can confidently conclude that MSS downlink/FS sharing is feasible,[84] a position which API and AAR share, arguing that COMSAT's sharing model does not demonstrate the feasibility of sharing between MSS and FS, because it assumes too high a level of acceptable interference[85] and neglects a fading model and degradation criteria.[86] Motorola goes on to state that it believes that sharing is not possible in the long term, and cites the conclusions of the *Report of the Conference Preparatory Meeting* for WRC-95, which rates the feasibility of MSS downlink/FS sharing as "Moderate-Poor." Motorola therefore advocates immediate clearing of the 2165-2200 MHz band.[87] AFCCE and CBT also state that sharing between MSS and FS is not feasible, and that relocation of FS licensees is necessary.[88]

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[79] *See id.* at ¶ 13.

[80] *See* Celsat Comments at 8-10; COMSAT Comments at 17-21; LQP Comments at 14-16.

[81] *See* COMSAT Comments at 18, Appendix 2.

[82] *See* Constellation Comments at 3.

[83] *See* LQP Comments at 16.

[84] *See* Motorola Reply at 16-23.

[85] *See* API Reply at 6-8.

[86] *See* AAR Reply at 2-4. *See also* UTC Reply at 9.

[87] *See* Motorola Comments at 15-18 (citing *CPM Report*).

[88] *See* AFCCE Comments at 2; CBT Comments at 7.

37. In supplemental comments, the MSS Coalition states that MSS and FS will be able to share spectrum for several years, and therefore proposes that a gradual transition plan for FS incumbent relocation be adopted.[89] Hughes favors the MSS Coalition MSS/FS sharing plan.[90]

38. The majority of FS commenters argue that there are inadequacies in the MSS Coalition's sharing study.[91] TIA states that WRC-95 only set out the criteria for MSS/FS sharing studies and then encouraged others to conduct the studies.[92] API, Alcatel, and TIA contend that MSS/FS sharing criteria should not be based on international standards.[93] TIA and Alcatel in particular point out that there are differences between U.S. and international FS systems,[94] and API states that U.S. interference standards are stricter than international standards; therefore, they urge us to rely upon U.S. criteria.[95] API, APCO, and Alcatel suggest that we rely on TIA's TR14.11 committee to do any necessary MSS/FS sharing studies.[96] The State of California (California) points out that COMSAT's proposal fails to take into account those highly populated areas where interference is likely to occur sooner, and that the proposal fails to recognize interference from MSS space or earth stations.[97] UTC states that the MSS Coalition fails to provide any details of how MSS and FS can share in the 2 GHz band.[98] The Central Iowa Power Cooperative (CIPCO) states that some of its FS paths are over 18 miles in length. If sharing were required then CIPCO would have to lower the operating power of its equipment to accommodate MSS, increasing the chances that its FS operations would receive unacceptable interference.[99]

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[89] *See* MSS Coalition Supplemental Comments at 4, 8-10, 17-22. *See also* LQP Supplemental Comments at 4.

[90] *See* Hughes Supplemental Comments at 2.

[91] *See* AAR Supplemental Comments at 6; APCO Supplemental Comments at 4-6; Dr. Bellamy Supplemental Comments at 1; California Supplemental Comments at 2, 4; CBPC Supplemental Comments at 1; UTC Supplemental Comments at 4-6.

[92] *See* TIA Supplemental Comments at 7-9.

[93] *See* Alcatel Supplemental Comments at 2-3; API Supplemental Comments at 7-8; TIA Supplemental Comments at 2-3.

[94] *See* Alcatel Supplemental Comments at 2-3; TIA Supplemental Comments at 2-3.

[95] *See* API Supplemental Comments at 7-8.

[96] *See* API Supplemental Comments at 7-8; Alcatel Supplemental Comments at 2-3; APCO Supplemental Comments at 4-6.

[97] *See* California Supplemental Comments at 2-5.

[98] *See* UTC Supplemental Comments at 4-6.

[99] *See* CIPCO Supplemental Comments at 4.

39. *Comments on Relocation.* If sharing proves to be infeasible, MSS interests generally advocate a gradual transition of FS incumbents to other spectrum, with FS incumbents paying all or most of the costs of their relocation.[100] For example, PCSAT advocates relocation of FS over a gradual transition period so as to require FS licensees to pay for their own relocation as they amortize their equipment. In the alternative, PCSAT states that we should limit the compensation from MSS to FS to the incremental replacement costs of FS equipment.[101] LQP suggests creating a FAC to resolve transition issues, such as the apportionment of FS relocation costs.[102] TRW notes that part of the recently allocated PCS spectrum (1970-1990 MHz) had been internationally allocated to MSS, and if MSS had received this allocation domestically instead of PCS, FS would not have to be relocated because of MSS. Therefore, TRW concludes, PCS operators should have to pay at least part of the relocation costs of FS.[103] Iridium proposes that we adopt a sunset policy on compensation for FS relocation similar to that used in our 1982 Digital Broadcasting Service proceeding. During the sunset period MSS would compensate FS licensees for relocation, but after this period, FS licensees would have to pay their own relocation expenses.[104] Celsat suggests allowing MSS to relocate FS incumbents in increments as MSS needs more spectrum.[105]

40. API and APCO, on the other hand, recommend that FS not be relocated for fear of disruption of safety-related services provided by private FS licensees, claiming that relocation is a difficult and time-consuming process with inherent uncertainty and risk. If relocation is necessary, they recommend that provisions to effect the relocation be made without delay.[106] Southwestern Bell stresses that reallocation of FS from the 2160-2180 MHz band to higher bands would harm cellular service providers, because of the resultant need for shorter paths for cellular service backhaul links and increased equipment costs.[107] All of the FS commenters agree with our proposal in the *Notice* that our Emerging Technologies rules should be followed.[108]

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[100] *See* Celsat Comments at 8-10; COMSAT Comments at 17-21; LQP Comments at 14-16.

[101] *See* PCSAT Comments at 6-10.

[102] *See* LQP Comments at 18-19.

[103] *See* TRW Comments at 7-9.

[104] *See* Iridium Comments at 1-2 (citing *In re Inquiry into the Development of Regulatory Policy in Regard to Direct Broadcast Satellites for the Period Following the 1983 Regional Administrative Conference*, GEN Docket No. 80-603, FCC 82-285, *Report and Order*, 90 F.C.C.2d 676 (1982)).

[105] *See* Celsat Comments at 8-10.

[106] *See* API Comments at 9-14; APCO Comments at 2-3.

[107] *See* Southwestern Bell Comments at 1-3.

[108] *See* API Comments at 12-14; AAR Comments at 2-5; APCO Comments at 2-3; BellSouth Comments at 3-4; UTC Comments at 1-2.

41. In supplemental comments, the Corn Belt Power Cooperative (CBPC), APCO and the Minnesota Department of Transportation (MDOT) point out that the MSS Coalition's plan to relocate FS over a ten-year period by allowing FS incumbents to amortize their equipment and replace it with the appropriate equipment at their own expense is unrealistic.[109] MDOT states that it uses its equipment for up to 30 years, and to amortize its current equipment will take 20 years.[110] APCO states that the average life of microwave equipment is 15-20 years, and that some private FS licensees have new equipment which would not be amortized until the decade of the 2010s.[111] Ameritech points out that WRC-95 moved up the date MSS is to have primary access in the 2 GHz spectrum from the year 2005 to the year 2000, making COMSAT's ten-year plan unrealistic.[112] The Los Angeles County Sheriff's Department (L.A. Sheriff) asserts that public safety FS incumbents should not have to pay any direct or indirect cost associated with relocation, because otherwise this burden would be passed on to taxpayers.[113] The majority of FS commenters and other commenters advocate applying the Emerging Technologies rules adopted in ET Docket No. 92-9.[114]

42. *Decision.* We will provide for MSS sharing with, and any necessary relocation of, FS incumbents in accordance with the policies set forth in our Emerging Technologies proceeding. It is our policy to encourage spectrum sharing between emerging technologies services and incumbent 2 GHz FS operations whenever technically feasible.[115] Our rules do not require relocation of incumbents unless and until the incumbents will receive harmful interference from, or cause harmful interference to, a new technology service. COMSAT and LQP have provided studies indicating that sharing is possible on at least a short-term basis. At the same time, Motorola and some FS service representatives have criticized these studies, claiming that they fail to account for important factors. MSS and FS industry groups are currently working under the auspices of TIA to resolve differences over sharing models and adopt a set of mutually agreed sharing criteria. We encourage these efforts, and will consider the product of these efforts for inclusion in our rules as the standard for evaluating the likelihood of unacceptable MSS/FS interference. MSS cannot begin operations until its spectrum is cleared of all FS licensees who

[109] *See* MDOT Supplemental Comments at 2-3; APCO Supplemental Comments at 3-4.

[110] *See* MDOT Supplemental Comments at 2-3.

[111] *See* APCO Supplemental Comments at 3-4.

[112] *See* Ameritech Supplemental Comments at 3-5.

[113] *See* L.A. Sheriff Supplemental Comments at 2.

[114] *See* API Supplemental Comments at 10-11; Ameritech Supplemental Comments at 3-5; AAR Supplemental Comments at 2-4, 9-11; APCO Supplemental Comments at 3-4; BellSouth Supplemental Comments at 6; CIPCO Supplemental Comments at 5; UTC Supplemental Comments at 3-4.

[115] *See, e.g., Emerging Technologies, First Report and Order and Third Notice of Proposed Rule Making* at ¶ 29.

would receive harmful interference from MSS, but MSS will not be required to relocate any FS incumbent with whom it can successfully share spectrum. If a specific FS operation does not receive unacceptable levels of interference until several years after the beginning of MSS operations, MSS will not be required to relocate the FS licensee until that interference occurs.

43. Where sharing proves infeasible, however, we will allow the MSS operator to relocate the incumbent FS operation to bands above 5 GHz. We will address the precise mechanism for relocation in the *Further Notice*, below.

D. *Technical Parameters for MSS Systems.*

44. In the *Notice*, we proposed to make the newly-allocated MSS bands available for both GSO and LEO use; otherwise, we did not propose specific technical parameters for MSS systems in the 1990-2025 MHz and 2165-2200 MHz bands. We requested comment, however, on whether these proposed new MSS bands should be limited to either exclusive GSO or LEO use; on whether minimum geographic coverage requirements or a particular access method, such as CDMA, should be mandated for all MSS licensees; on what power limits should be imposed; on Celsat's proposal to share spectrum with PCS at 1970-1990 MHz in order to provide a hybrid PCS/MSS system; and on whether there is a need to allocate spectrum for feeder links to support 2 GHz MSS.[116] These issues were addressed primarily by commenters who are potential MSS service providers or MSS equipment manufacturers.

45. *Comments.* With regard to orbital geometries,[117] Celsat advocates reservation of the entire 70 megahertz of spectrum for GSO systems, because MSS spectrum in the 1.6/2.4 GHz band is reserved exclusively for LEO systems and licensed to MSS providers using these systems. Reserving the spectrum at issue to GSO systems, according to Celsat, will ensure diversity of service providers and encourage competition.[118] COMSAT and others disagree, stating that we should mandate no orbital geometry now, and that we should either allow the market to decide what is the best orbital geometry[119] or wait until after an allocation plan is finished to decide this issue.[120] In its reply comments, LQP asserts that we should reject Celsat's attempt to close this spectrum to current MSS licensees employing LEO systems by mandating GSO, because the Commission can encourage competition, as Celsat urges, by licensing multiple systems, and because current satellite providers are in the best position to improve service.

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[116] *See Notice* at ¶ 16.

[117] Orbital geometries are the type of orbits satellites describe, such as GSO or LEO.

[118] *See* Celsat Comments at 11.

[119] *See* COMSAT Comments at 33; Ericsson Comments at 1-3; Newcomb Comments at 2-7; TRW Comments at 25.

[120] *See* LQP Comments at 20-23.

46. With regard to access methods, Celsat states that we should mandate use of CDMA technology, which it claims will allow many licensees to share the same spectrum and permit more energy-efficient coding, greater tolerance for interference from incumbent licensees, greater protection from interference to incumbent licensees, and greater frequency re-use, as well as avoid mutual exclusivity in licensing.[121] Newcomb adds a recommendation that we either adopt CDMA, or split the band into sub-bands of 17.5 megahertz in each direction, for separate assignment to GSO and LEO systems.[122] LQP argues that we should wait until after we finish allocating spectrum to MSS to take up technical issues.[123] Other commenters disagree with Celsat, stating that we should remain technologically neutral and allow the market to decide the best access methodology.[124] In its reply comments, LQP adds that CDMA is superior to time division multiple access (TDMA) in terms of multiple entry, capacity, and spectrum efficiency, but continues to advocate waiting until after the allocation is made to decide the issue.[125]

47. With regard to geographic coverage requirements, COMSAT advocates the imposition of the same requirements as those imposed on Big LEOs, *i.e.*, coverage of the entire globe from 70°N to 55°S for 75% of each day, stating that these would provide effective global coverage while containing costs.[126] LQP, PCSAT, and TRW argue that imposing no coverage standard will allow for more varied and flexible MSS system design.[127] Motorola states that LEO and GSO systems should be assigned to separate bands, with GSO systems allowed to provide coverage only in regions they choose to serve.[128] In its reply comments, Celsat argues that we should allow for GSO-based domestic-only service in at least part of the band, stating that this will allow lower-cost domestic systems that will not have to pay for the capacity needed for international coverage.[129]

48. With regard to power limits, COMSAT argues that there is no reason to limit the power from MSS handsets, except to the extent necessary to meet existing RF hazard guidelines

[121] *See* Celsat Comments at 11-18. *See also* TRW Comments at 24.

[122] *See* Newcomb Comments at 7-9.

[123] *See* LQP Comments at 20-23.

[124] *See* COMSAT Comments at 33-34; Ericsson Comments at 1-3; Motorola Comments at 11-14.

[125] *See* LQP Reply at 16-18.

[126] *See* COMSAT Comments at 34.

[127] *See* LQP Comments at 20-23; PCSAT Comments at 4-5; TRW Comments at 25.

[128] *See* Motorola Comments at 10-11.

[129] *See* Celsat Reply at 14-17.

for handheld transmitters.[130] COMSAT further argues that coordination with other services in the downlink band is preferable to setting absolute power limits.[131] Motorola states that no power limit should be placed on the band,[132] and LQP believes that the issue should be taken up later.[133] Only TRW advocates a specific power limit, stating that in order to maximize capacity and minimize interference, we should specify a maximum power flux density from each space station of -137 dB(W/m^2/4 kHz).[134]

49. With regard to feeder link spectrum, COMSAT asserts that 2 GHz MSS should be allowed to use any Fixed-Satellite Service (FSS) bands allocated by WRC-95 for MSS feeder links.[135] PCSAT states that feeder link spectrum in the 11 GHz and 13 GHz bands, currently allocated to FSS, should be authorized for MSS use, and points out that the American Mobile Satellite Corporation's first generation MSS system already uses these bands for feeder links.[136]

50. Finally, with regard to Celsat's proposal to allow these bands to be used to create a hybrid PCS/MSS system, in which a single hand-held earth terminal could access either terrestrial PCS or MSS,[137] LQP argues that such a system would, in part, merely replicate terrestrial PCS, and therefore would not be an efficient use of spectrum.[138] Celsat replies that its proposed system would not be merely redundant, but would be more flexible than terrestrial PCS alone, and would immediately cover areas where PCS is not available and marginal areas, such as sparsely-populated rural regions.[139]

51. *Decision.* We are deferring consideration of these technical issues until after we have accepted applications for system licenses in these bands. We are not persuaded by arguments for or against restricting use of the spectrum exclusively to either GSO or LEO systems. Either system can provide global coverage, and while a GSO system offers many advantages for domestic-only systems, we do not wish to rule out innovative designs before they are submitted.

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[130] *See* 47 C.F.R. § 2.1093.

[131] *See* COMSAT Comments at 35-36.

[132] *See* Motorola Comments at 11-14.

[133] *See* LQP Comments at 20-23.

[134] *See* TRW Comments at 26.

[135] *See* COMSAT Comments at 37.

[136] *See* PCSAT Comments at 5.

[137] *See Notice* at ¶ 3.

[138] *See* LQP Comments at 23.

[139] *See* Celsat Reply at 14-17.

Further, as Motorola pointed out, in our proceeding to license Big LEO systems, we concluded that there was no support for a finding that CDMA is inherently superior to TDMA as an access method.[140] We believe that the market will be the best judge of the relative desirability of different access methods. We also believe that we will be in a better position to determine whether and what power limits we should adopt and to evaluate Celsat's proposal for a hybrid PCS/MSS system after we have received license applications and supporting documentation. Finally, we will address feeder link spectrum in proceedings addressing those bands.

E. *Licensing by Competitive Bidding.*

52. In the *Notice*, we notified the public of our intent to award licenses for MSS in these bands by competitive bidding. We stated our belief that, of the options for awarding MSS licenses, competitive bidding best serves the public interest where mutual exclusivity exists among applicants. We sought comment on whether our proposal to award licenses by simultaneous multiple round bidding was the most appropriate method of awarding MSS licenses.[141]

53. *Comments.* All commenters opposed the idea of awarding MSS licenses by competitive bidding. First, commenters argue that we are required to show mutual exclusivity in order to use competitive bidding for licenses, and that we have not done so, because we have not yet accepted applications for licenses.[142] Several state that engineering solutions such as the use of CDMA, or negotiations, service rules, and financial qualification thresholds can be used to avoid mutual exclusivity.[143] Noting that MSS is international in nature, commenters assert that licensing by competitive bidding raises two international problems. First, auctioning MSS spectrum in the United States could "open the door" for other countries to require MSS providers to pay for the same spectrum in each country.[144] Second, the international coordination process required before MSS providers could begin service would make it uncertain exactly how much spectrum any MSS provider would actually receive, which in turn would make it extremely difficult to assign an appropriate value to the spectrum.[145] Several commenters state that the cost of spectrum auctions, added to the costs of relocation of incumbent licensees and system costs,

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[140] *See Big LEOs, Report and Order*, 9 FCC Rcd 5936 at n. 52 (1994).

[141] *See Notice* at ¶ 17.

[142] *See* Constellation Comments at 4; GE Americom Comments at 4-5; Hughes Comments at 2-5; Motorola Comments at 26-27; PCSAT Comments at 11-13; Teledesic Comments at 10-14; TRW Comments at 18-20.

[143] *See* COMSAT Comments at 25-27; GE Americom Comments at 4-5; LQP Comments at 25-27; PCSAT Comments at 11-13; Teledesic Comments at 10-14; TRW Comments at 18-20.

[144] *See* COMSAT Comments at 27-30; GE Americom Comments at 20; Hughes Comments at 2-5; Motorola Comments at 25-26; PCSAT Comments at 13-14; Teledesic Comments at 10-14; TRW Comments at 21-23.

[145] *See* GE Americom Comments at 15-16; Hughes Comments a 2-5, Motorola Comments at 25-26; PCSAT Comments at 13-14; TRW Comments at 21-23.

would make MSS economically infeasible.[146] A number of commenters argue that auctions would also put MSS at a competitive disadvantage with respect to foreign MSS systems and Big LEOs, and would not be consistent with our stated goal of providing low-cost service to underserved and rural areas.[147] Celsat asserts that if we assign this spectrum by competitive bidding, small businesses -- defined by Celsat as businesses with annual revenues of less than $125 million and assets of less than $500 million -- should be given a 15 percent bidding credit and a favorable payment plan, in order to promote competition.[148]

54. *Decision.* We will defer the decision on whether to license MSS in these bands by competitive bidding until after we have accepted applications for licensing. As many commenters point out, we will not know if there is mutual exclusivity until we receive license applications. At that point, we will decide whether engineering solutions or other methods may solve mutual exclusivity, and if not, precisely how we will structure auctions.

F. *Disposition of Celsat's Pioneer's Preference Request.*

55. Our pioneer's preference rules were established to provide a means of extending preferential treatment in our licensing processes to parties that demonstrate their responsibility for developing new communications services and technologies.[149] A party awarded a pioneer's preference receives the right to obtain a license to operate in the service that it has innovated, using the design and technologies upon which its award is based. The pioneer's preference rules ensure that innovators have an opportunity to participate either in new services which they take a lead in developing or in existing services which they substantially enhance. A pioneer's preference applicant must persuade us that its proposal is innovative, has merit, and that it is the original developer of the innovation at issue.

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[146] *See* COMSAT Comments at 29-30; GE Americom Comments at 15-16;Hughes Comments at 2-5; Motorola Comments at 25-26; PCSAT Comments at 11-13; CEPT Reply at 2; LQP Reply at 23-27.

[147] *See* Hughes Comments at 2-5; Motorola Comments at 25-26; PCSAT Comments at 13-14; Teledesic Comments at 10-14; TRW Comments at 21-23; I-CO Reply at 2.

[148] *See* Celsat Comments at 19-20.

[149] The pioneer's preference regulations are codified at 47 C.F.R. §§ 0.241, 1.402, and 5.207. *See Establishment of Procedures to Provide a Preference*, GEN Docket No. 90-217, *Report and Order (Pioneer's Preference Report and Order)*, 6 FCC Rcd 3488 (1991), *recon. granted in part, Memorandum Opinion and Order*, 7 FCC Rcd 1808 (1992), *further recon. denied, Memorandum Opinion and Order*, 8 FCC Rcd 1659 (1993). In October 1993, the Commission initiated a review of the pioneer's preference rules; *see* ET Docket No. 93-266, *Notice of Proposed Rule Making*, 8 FCC Rcd 7692 (1993); *First Report and Order*, 9 FCC Rcd 605 (1994), *recon. denied, Memorandum Opinion and Order*, 9 FCC Rcd 6837 (1994); *Second Report and Order and Further Notice of Proposed Rule Making*, 10 FCC Rcd 4523 (1995), *recon. denied, Memorandum Opinion and Order*,11 FCC 2468 (1996); *Third Report and Order*, 10 FCC Rcd 13183 (1995), *recon. granted, Memorandum Opinion and Order*, 11 FCC 2468 (1996). *See also* ET Docket No. 93-266 and GEN Docket No. 90-314 (broadband PCS), *Memorandum Opinion and Order on Remand*, 9 FCC Rcd 4055 (1994).

56. Under the pioneer's preference rules, a necessary condition for the award of a preference is that the applicant demonstrate that it has developed the capabilities or possibilities of a new technology or service, or demonstrate that it has brought the technology or service to a more advanced or effective state.[150] A preference is granted only if the service rules adopted are a reasonable outgrowth of the applicant's proposal and lend themselves to the grant of a preference.[151] The applicant must also demonstrate that the new technology or service is technically feasible by submitting either the summarized results of an experiment or a technical showing.[152] Finally, preferences are not granted casually. Rather, each applicant has a significant burden to persuade us that its proposal is innovative.[153]

57. In conjunction with its February 1992 Petition for Rule Making (RM-7927), Celsat filed a pioneer's preference request. Celsat amended its petition in July 1993 and amended its pioneer's preference request in December 1993. As described in its amended petition, Celsat seeks a pioneer's preference for an integrated GSO satellite/terrestrial cellular and micro-cellular mobile service that would use code division multiple access (CDMA) technology. Celsat maintains that this system would have benefits and advantages in cost and overall spectrum efficiency relative to separate PCS and MSS systems. It states that its hybrid MSS service could operate in either a portable (personal) or mobile (vehicular) terrestrial mode, but is primarily a satellite service. Celsat submits that this service will provide important new features, such as position determination, transmissions with data speeds of up to 144 kilobits per second, and compressed video, in addition to conventional mobile voice and messaging. Celsat further states that because its system will cover only the United States, coordination with other nations will be relatively simple. Celsat contends that its proposed service would allow direct access to satellite communications through personal handsets and that it will be able to share spectrum with terrestrial PCS without interference.

58. In April 1992, AMSC Subsidiary Corporation (AMSC), GTE Service Corporation (GTE), Loral Qualcomm Satellite Services, Inc. (LQSS), and TRW each filed oppositions to Celsat's pioneer's preference request. AMSC argues that the concept of a single mobile system using terrestrial and satellite elements in different geographic areas on the same frequencies is not novel, and that Celsat has not developed and tested the technology necessary to create such a system. GTE concurs, contending that Celsat was not the first party to propose integrating mobile satellites with terrestrial-based mobile systems, and that Celsat has failed to make a technical feasibility showing. GTE also argues that the time delay inherent in a GSO personal communications system may render it undesirable to consumers, and that Celsat should have employed market surveys or tests to demonstrate consumer acceptance of such delays. LQSS

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[150] *See* 47 C.F.R. § 1.402(a).

[151] *See id.*

[152] *See* 47 C.F.R. § 5.207.

[153] *Pioneer's Preference Report and Order*, 6 FCC Rcd 3494, at ¶ 48.